Audio Mimicry in Moths?

By A. C. Morton, B.Sc.*

It is well known that insectivorous bats are able to find their prey while flying in complete darkness by emitting a series of ultrasonic cries and locating the direction and distance of sources of echoes. Since animals must be able to perceive and react to predators if they are to survive, it is perhaps not surprising to find that some night-flying moths — notably members of the families Noctuidae, Geometridae and Arctiidae — have ears that can detect the bats' untrasonic cries. On hearing the approach of a bat, these moths take evasive action, abandoning their usual cruising flight to go into sharp dives or erratic loops. Moths taking such evasive action on a bat's approach have a significantly higher chance of survival than those that continue on course (Roeder, K. N. & A. E. Treat, 1961, *American Scientist*, **49**: 135-148).

In this contest of hide-and-seek it would seem much to a moth's advantage to remain as quiet as possible, since the sensitive ears of a bat would soon locate a noisy target. It is therefore surprising to note that many moths of the family Arctiidae are capable of generating trains of ultrasonic clicks, and do so if they are exposed to a string of ultrasonic pulses while they are suspended in a stationary flight. As such altruism is not characteristic of the predator-prey relationship one is left to question the value of this aspect of the moth's behaviour.

Dorothy C. Dunning and Professor Kenneth Roeder of Tufts University demonstrated that the clicks made by arctiids seem to be heeded by bats as a warning (*Science*, **147**: 173-174; 1965). Partly tamed bats, trained to catch mealworms that were tossed into the air by a mechanical device, commonly swerved away from their target if they heard tape-recorded arctiid clicks just before the moment of contact.

Bats, of course, are not the only predators moths must try to avoid. Moths are also at risk when they are resting during the day and like many other animals they often seek protection by employing cryptic colouration, or adopting warning colouration and patterns to advertise the fact that they are unpalatable. It is noticeable that some striking examples of warning colouration are displayed by arctiid moths, and it surely cannot be mere coincidence that it is apparently these species which emit clicks that bring about avoidance behaviour in bats. Clearly, an unpalatable species cannot use warning colouration to advertise this fact to nocturnal predators, and thus it would seem that an additional system had to be evolved.

However, not all the species of moths which emit such clicks possess warning colouration, so it might be that these species are in fact palatable. But they can reduce nocturnal predation by adopting the clicking behaviour of the unpala-

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table models they mimic. If this is so, it would seem that in the moths there is an example of non-visual mimcry which has so far attracted little attention.

Sound mimicry seems to have been detected by Gaul in 1952 (*Psyche*, **59**; 82-83) in the wasp *Dolichovespula arenaria* and fly *Spilomyia hamifera*; two species which are found in the north-eastern United States and are extremely similar in appearance. In 1965 Brower and Brower (*Am. Nat.*, **99**; 173-188) showed that sound mimicry also occurred in the drone fly *Elisratis vinetorum*, which mimics *Apis mellifera*. However, I have not managed to find any reference to an example where sound mimicry is not an adjunct to colour mimicry and thus the possibility of this occurring in moths is most interesting.

I have recently begun to examine this possibility in more detail and would be most grateful if any readers would be prepared to assist me by providing living specimens of any common species of the families Noctuidae, Geometridae and Arctiidae for tests of clicking behaviour and palatability.

SELECTION of **Lectotype** OF UGYOPS CAELATUS (WHITE) — *Ugyops caelatus* (Fulgoroidea: Delphacidae) was described by F. B. White (under the preoccupied generic name of *Cona*) on the basis of an unspecified number of adults and nymphs collected in New Zealand and presented to him by a Captain Broun (1879, *Entomologst's Mon. Mag.*, **15**: 218). Since White's death, the location and even the existence of this material have remained generally unknown until very recently, when Mr. M. A. Taylor, Keeper of Natural Sciences at the Perth Museum, found a part of it, if not the whole, while reorganising the White collection in this museum. It comprises seven males and five females of *U. caelatus*, ten nymphs, probably of this species, and eight females and one mutilated specimen of *U. pelorus* Fennah. No type specimen was designated by White for his species, and none has been selected since. All the specimens are covered by the original description and have syntypical status. I have accordingly selected and now designate a lectotype for *Ugyops caelatus* (White) (= *Cona caelata*). LECTOTYPE, male (of two gummed on a card) with tegmina and hind legs extended; mount with letters "NZB" (New Zealand, Broun) pencilled below; pin bearing three labels — "Buchanan White colln. large cabinet 22", "Perth Museum 1979 1574 9", "*Ugyops* [*Cona*] *caelatus* (White) det. R. G. Fennah". The specimen chosen conforms with the characterisation given by Hutton (1898, *Trans. N.Z. Institute* **30**: 187) and myself (1965, *Bull. Brit. Mus.* (*Nat. Hist.*) *Ent.* **17**: 7). No specimen agreeing with the figure (Q30) given by Tillyard (1926, *Insects of Australia and New Zealand*, 167) was found in the type series. — R. G. FENNAH, c/o Commonwealth Institute of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD.